



## Surf's Up: How to Catch a Perfect Wave

*Researchers in France build a beach-like mini-Maui in the Laboratory to quantify conditions necessary for a surfer to catch a wave*

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EMBARGOED for release until 2:45 p.m. ET on Tuesday, November 24, 2015  
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WASHINGTON, D.C., November 24, 2015 -- Along coastlines from California to Australia, you'll see surfers trying to catch that perfect wave. How they find and ride that wave relies on feel and intuition, developed through skill and experience. Now researchers from the LadHyX Hydrodynamics Laboratory of École Polytechnique in France are trying to quantify this ability, studying the conditions necessary for a surfer to catch a wave.

Surfers in wait are floating and drifting, moving slowly compared to the speed of the waves. To catch a wave, surfers need to accelerate -- by paddling and by letting other waves push them -- until they reach the same speed as the target wave. Once they've caught up to the wave, they can ride it, allowing it carry to them along the water's surface. But no one knows the exact conditions of the wave and surfboard that make this possible.

To answer this question, Eline Dehandschoewercker, Ph.D. student with Christophe Clanet and David Quéré, built a miniature surfing spot in the lab. She will describe it at the American Physical Society's 68<sup>th</sup> Annual Meeting of the Division of Fluid Dynamics, taking place from Nov. 22-24, 2015 in Boston, Mass.

She made an apparatus that generates small waves of about 40 cm long in a tank. The device can create periodic waves, which are smooth and steady. Or it can create breaking waves, which have steep slopes. To mimic surfboards, she used pieces of balsa wood about 10 cm long that can submerge at different depths, and that have different lengths, widths and mass distributions.

In the experiments, Dehandschoewercker focused on how waves accelerate the board until it catches one of them, measuring the force from the undulations with a sensor connected to the board by a thin plastic rod.

The researchers found that the steeper the wave's slope, the easier it was for the board to catch a ride on the wave. They also found that the board has to be submerged in the water at just the right depth. Otherwise, the moving water can't accelerate it enough to catch the wave.

Eventually, these kinds of measurements could potentially help design better surfboards, Dehandschoewercker said. But this research could also lead to a novel cargo delivery system.

In the future, ships might use waves to deliver cargo to places without ports, explains Christophe Clanet. The ships can be fitted with machines that create waves with specific amplitudes and wavelengths. Large, wave-riding surfboards can then carry cargo toward shore. "Waves are a very efficient way to transport things," he said.

Surfing isn't just for humans and cargo, either. Organisms ranging from dolphins to plankton also travel by hitching a ride on a wave. Analyzing the details of surfing can help scientists better understand such behavior in nature.

Presentations # R31.10, "Surfboard Dynamics," is authored by Eline Dehandschoewercker, David Quere and Christophe Clanet. It will be at 2:47 p.m. on Tuesday, Nov. 24, 2015 in Room 312 of the Hynes Convention Center in Boston.

ABSTRACT: <http://meetings.aps.org/Meeting/DFD15/Session/R31.10>

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## **MEETING INFORMATION**

The 68th Annual Division of Fluid Dynamics Meeting will be held at Hynes Convention Center in Boston, Mass. from Nov. 22-24, 2015. More meeting information: <https://apsdfd2015.mit.edu/>

## **REGISTERING AS PRESS**

Any journalist, full-time or freelance, may attend the conference free of charge. Please email: <[jbardi@aip.org](mailto:jbardi@aip.org)> and <[dfdmedia@aps.org](mailto:dfdmedia@aps.org)> and include "DFD Press Registration" in the subject line.

## **ON-SITE AND ONLINE PRESS ROOMS**

Workspace will be provided on-site during the meeting. The week before the meeting, news, videos and graphics will be made available on the Virtual Press Room: <http://www.aps.org/units/dfd/pressroom>

## **LIVE MEDIA EVENT**

A press briefing featuring a selection of newsworthy research talks will be streamed live from the conference at 1:00 p.m. ET on Monday, Nov. 23. For more information, email [jbardi@aip.org](mailto:jbardi@aip.org).

## **ABOUT THE APS DIVISION OF FLUID DYNAMICS**

The Division of Fluid Dynamics (DFD) of the American Physical Society (APS) exists for the advancement and diffusion of knowledge of the physics of fluids with special emphasis on the dynamical theories of the liquid, plastic and gaseous states of matter under all conditions of temperature and pressure. DFD Website:

<http://www.aps.org/units/dfd/index.cfm>

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Image Caption: The surfer (a) waits for the approaching wave, (b) starts paddling, (c) takes off, (d) stands on the board and (e) rides the wave.

Credit: Alexandre de Sales/Uhabia, Bidart

Video Caption: The apparatus generates small waves, both periodic and breaking, in a tank, with balsa wood to mimic surfboards, and researchers focus on how waves accelerate the board until it catches one of them.

Credit: Eline Dehandschoewercker